

- 1 1. A method of answering a question based on information stored on a computer-
2 readable medium comprising the steps of
3 receiving a question;
4 parsing the question to obtain an analyzed question;
5 matching the analyzed question to a set of predetermined question patterns
6 to obtain matched question patterns;
7 transforming the matched question patterns into one or more partially
8 unspecified statements, wherein each of the partially unspecified
9 statements is missing a portion corresponding to an answer;
10 generating partially unspecified queries corresponding to the partially
11 unspecified statements; and
12 obtaining answers by matching the partially unspecified queries to stored
13 information.
14
- 15 2. The method of claim 1, wherein the transforming step further comprises:
16 transforming matched question patterns into one or more partially
17 unspecified statements using syntactic frames.
18
- 19 3. The method of claim 1, further comprising the step of:
20 collecting answers from matching the partially unspecified queries across
21 a plurality of documents in the stored information.
22
- 23 4. The method of claim 1, further comprising the step of:
24 ranking each obtained answer according to its frequency of matching.
25
- 26 5. The method of claim 1, wherein the stored information comprises a set of
27 documents and an index identifying which documents within the set of documents
28 contain terms or groups of terms answering the partially unspecified queries.

- 1 6. A method of answering a question based on documents stored on a computer-
2 readable medium comprising the steps of:
3 storing contexts for terms, wherein a context occurs in a document;
4 receiving a question;
5 transforming the question into one or more partially unspecified queries;
6 and
7 identifying a match or a set of matches for the one or more partially
8 unspecified queries within the contexts, thereby providing an answer or a
9 set of answers for the question.
10
- 11 7. A method for answering a question based on information stored on a computer-
12 readable medium comprising the steps of:
13 receiving a question;
14 transforming the question into one or more partially unspecified queries;
15 and
16 identifying a match or a set of matches within a body of information
17 stored on a computer-readable medium for each of one or more of the
18 partially unspecified queries, thereby providing an answer or a set of
19 answers for the question.
20
- 21 8. The method of claim 7, wherein the partially unspecified query comprises a
22 partially unspecified term.
23
- 24 9. The method of claim 7, wherein the question contains a question word or phrase
25 and wherein the transforming step comprises:
26 replacing the question word or phrase with a partially unspecified term.
27
- 28 10. The method of claim 9, wherein the partially unspecified term comprises a
29 restriction that is determined, at least in part, by the question word or phrase.

- 1
2 11. The method of claim 7, wherein the transforming step comprises:
3 transforming the question into one or more statement patterns; and
4 transforming one or more of the statement patterns into one or more
5 partially unspecified queries.
6
- 7 12. The method of any of claims 7, 8, 9, 10, 11, further comprising the steps of:
8 generating additional partially unspecified queries by using a thesaurus;
9 and
10 identifying a match or a set of matches within a body of information
11 stored on a computer-readable medium for each of one or more of the
12 additional partially unspecified queries.
13
- 14 13. The method of claim 12, wherein the thesaurus comprises a contextual thesaurus.
15
- 16 14. The method of any of claims 7, 12, or 13, wherein the identifying step comprises
17 identifying a match or a set of matches for each of a plurality of partially
18 unspecified queries, further comprising the step of:
19 combining the matches or sets of matches identified for each of a plurality
20 of partially unspecified queries, thereby generating a combined result set
21 for the question.
22
- 23 15. The method of any of claims 7, 12, or 13, wherein the identifying step comprises
24 identifying a match or a set of matches for each of a plurality of partially
25 unspecified queries, further comprising the steps of:
26 extracting a portion of each of a plurality of the identified matches; and
27 combining the extracted portions, thereby generating a combined result set
28 for the question.
29

- 1 16. The method of claim 11, wherein the first transforming step comprises one or
2 more of the following:
3
4 (a) analyzing the question, wherein the analyzing step comprises assigning
5 a grammatical label to each of a plurality of elements in the question;
6
7 (b) simplifying the question;
8
9 (c) assigning an identifier to some or all of the grammatical labels in the
10 question either before or after simplifying the question, thereby generating
11 a processed question.
12
- 13 17. The method of claim 16, wherein a different identifier is assigned to each subject
14 element, each object element, and each preposition element in the processed
15 question, thereby uniquely identifying each subject element, each object element,
16 and each preposition element in the processed question.
17
- 18 18. The method of claim 17, wherein the identifiers are numbers.
19
- 20 19. The method of claim 16, wherein the first transforming step comprises:
21 selecting one or more of a plurality of categories for the question or
22 processed question, wherein a category comprises a set of sentence
23 patterns that are grammatically related to one another, the sentence
24 patterns each including one or more statement patterns; and
25 selecting one or more of the statement patterns from the one or more
26 categories.
27
- 28 20. The method of claim 19, further comprising the steps of:

replacing a grammatical label in one or more of the selected sentence patterns with a partially unspecified term; and
 replacing the remaining grammatical labels in the one or more selected sentence patterns with the corresponding elements from the question, thereby generating one or more partially unspecified queries.

21. The method of claim 19, further comprising the steps of:
 adding grammatical labels indicating grammatically acceptable positions for modifiers to the selected sentence patterns;
 replacing a grammatical label in one or more of the selected sentence patterns with a partially unspecified term; and
 replacing the remaining grammatical labels in the one or more selected sentence patterns with the corresponding elements from the question, thereby generating one or more partially unspecified queries.

22. The method of claim 19, wherein the sentence patterns comprising a set of sentence patterns are grammatically related to one another in that each sentence pattern comprises a transformed version of a base sentence pattern, the base sentence pattern comprising one or more grammatical labels selected from the list consisting of subject elements, verb elements, object elements, and preposition elements and each transformed version comprises the same subject elements, verb elements, object elements, and preposition elements as the base sentence pattern.

23. The method of claim 22, wherein a transformed version is derivable from a base sentence pattern by subject the subject elements, verb elements, object elements, and preposition elements of the base sentence pattern to one or more of the following operations:

- (a) permutation of the order of the elements;
- (b) modification of the voice or aspect of a verb element; and

- 1 (c) addition of further grammatical labels, so as to generate a
 2 grammatically acceptable variant of the base sentence pattern.
 3
- 4 24. The method of claim 16, wherein the simplifying step comprises performing one
 5 or more of the following operations on the question after analyzing the question:
 6 (a) removing some or all auxiliary verbs and their corresponding
 7 grammatical identifiers;
 8 (b) removing some or all words that appeared in the original question
 9 while retaining their corresponding grammatical identifiers; and
 10 (c) (i) removing some or all words that form part of a noun phrase;
 11 (ii) removing the grammatical identifiers for the words removed in
 12 step (i); and
 13 (iii) retaining the grammatical identifier for the noun phrase.
 14
- 15 25. The method of either of claims 14 or 15, further comprising the step of:
 16 ranking the results in the combined result set.
 17
- 18 26. The method of claim 25, further comprising the step of:
 19 outputting some or all of the results in the combined result set in an order
 20 determined, at least in part, by the ranking.
 21
- 22 27. The method of either of claims 14 or 15, further comprising the step of:
 23 outputting an identifier or location of a document that contains a result.
 24
- 25 28. The method of claim 25, further comprising the step of:
 26 outputting an identifier or location of a document that contains a result.
 27
- 28 29. An apparatus for answering a natural language question comprising:

1 a grammar comprising rules for constructing sentences for grammatical
 2 elements;
 3 a parser employing the grammar in analyzing the natural language
 4 question and assigning a grammatical identifier to a plurality of
 5 grammatical elements in the question;
 6 a set of predetermined question frames for transforming the analyzed
 7 question into one or more partially unspecified queries; and
 8 a matching module for determining one or more answers to the natural
 9 language question by matching the one or more partially unspecified
 10 queries to information stored in a body of documents.

11
 12 30. An apparatus for answering a natural language question comprising:
 13 memory means to store a computer-executable process steps; and
 14 a processor that executes computer-executable process steps so as
 15 to receive a question,
 16 to transform the question into one or more partially unspecified
 17 queries, and
 18 to identify matches for the one or more partially unspecified
 19 queries in a body of information, thereby providing an answer to
 20 the question.

21
 22 31. Computer-executable process steps stored on a computer-readable medium, the
 23 computer-executable process steps comprising:
 24 code to receive a question;
 25 code to transform the question into a partially unspecified query; and
 26 code to identify a match for the partially unspecified query in a body of
 27 information, thereby providing an answer to the question.